MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

PIP0255 – INTRODUCTION to PHYSICS

(Foundation in Information Technology)

3 March 2020
9.00 A.M – 11.00 A.M
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 4 printed pages with 5 questions only, excluding the cover page, physical constants, and formula list.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

LIST OF PHYSICAL CONSTANTS

Acceleration due to gravity	g	$9.80\ \text{m/s}^2$
Electron mass	m_e	$9.11 \times 10^{-31}\ \text{kg}$
Proton mass	m_p	$1.67 \times 10^{-27}\ \text{kg}$
Elementary Charge	e	$1.602 \times 10^{-19}\ \text{C}$
Coulomb Constant	k	$9.0 \times 10^{9}\ \text{N m}^2\text{. C}^{-2}$
Permittivity of free space	ε_0	$8.85 \times 10^{-12}\ \text{C}^2\text{N}^{-1}\text{.m}^{-2}$

LIST OF FORMULA

NEWTONIAN MECHANICS

$$\omega = \frac{\Delta\theta}{\Delta t} \qquad v = r\omega \qquad a = r\alpha$$

$$\omega = \omega_o + \alpha t \qquad \theta = \frac{1}{2}(\omega_0 + \omega)t \qquad \theta = \omega_0 t + \frac{1}{2}\alpha t^2$$

$$\omega^2 = \omega_0^2 + 2\alpha\theta \qquad \theta = \omega t - \frac{1}{2}\alpha t^2 \qquad W = Fs\cos\theta$$

$$KE = \frac{1}{2}mv^2 \qquad PE_G = mgy \qquad p = mv \qquad \sum F = \frac{\Delta p}{\Delta t}$$

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2 \qquad m_1u_1 + m_2u_2 = (m_1 + m_2)\,v$$

ELECTRICITY

$q = Ne$

$F = k\frac{q_1 q_2}{r^2}$

$E = \frac{F}{q_o}$

$C = \frac{\varepsilon_0 A}{d}$

$Q = CV$

$C = \kappa C_0$

$C_{eq} = C_1 + C_2 + \ldots.$

$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots.$

$V = E\,d$

$U = \frac{1}{2} QV$

$U = \frac{1}{2} CV^2$

$U = \frac{Q^2}{2C}$

$I_{av} = \frac{\Delta Q}{\Delta t}$

$V = IR$

$R = \rho\frac{L}{A}$

$R_{eq} = R_1 + R_2 + \ldots$

$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$

$P = IV$

$P = I^2 R$

$P = \frac{V^2}{R}$

STRUCTURED QUESTIONS [50 MARKS]

Instructions: Answer **ALL** questions in this section.

Question 1 [10 marks]

a. A carousel is initially at rest. At $t = 0$ it is given a constant acceleration $\alpha = 0.050$ rad/s^2 , which increases it's angular velocity for 10.0 s. At $t = 10.0$ s determine the following quantities:

i. the angular velocity of the carousel. (1 mark)
ii. the linear velocity of a child located 2.5 m from the center. (1 mark)
iii. the the tangential (linear) acceleration of that child. (1 mark)
iv. the centrepetal acceleration of the child. (1 mark)

b. A bicycle slows down uniformly from $v_o = 8.0$ m/s to rest over a distance of 110 m. Each wheel has an overall diameter of 65.0 cm. Calculate

i. the angular velocity of the wheel at the initial instant ($t = 0$) (1 mark)
ii. the total number of revolutions each wheel rotates (in radian) before coming to rest. (2 marks)
iii. the angular acceleration of the wheel. (2 marks)
iv. the time it took to come to a stop. (1 mark)

Question 2 [10 marks]

a. A 1.5 m tall person lifts a 2.00 kg book from the ground so it is 2.5 m above the ground. What is the potential energy of the book relative to

i. the ground ? (1 mark)
ii. the top of the person's head ? (1 mark)

b. A 280 kg load is lifted 22.0 m vertically with an acceleration $a = 0.15g$ by a single cable.

i. Draw a free-body diagram of the load. (1 mark)
ii. Determine the tension in the cable. (2 marks)
iii. Calculate the work done by the cable on the load. (1 mark)

c. A 15.0 kg object moving in the $+x$ direction at 5.5 m/s collides head-on with a 10.0 kg object moving in the $-x$ direction at 4.0 m/s. Find the final velocity of each mass if

i. the objects stick together. (2 marks)
ii. the 15.0 kg object is at rest after collision. (2 marks)

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Question 3 [10 marks]

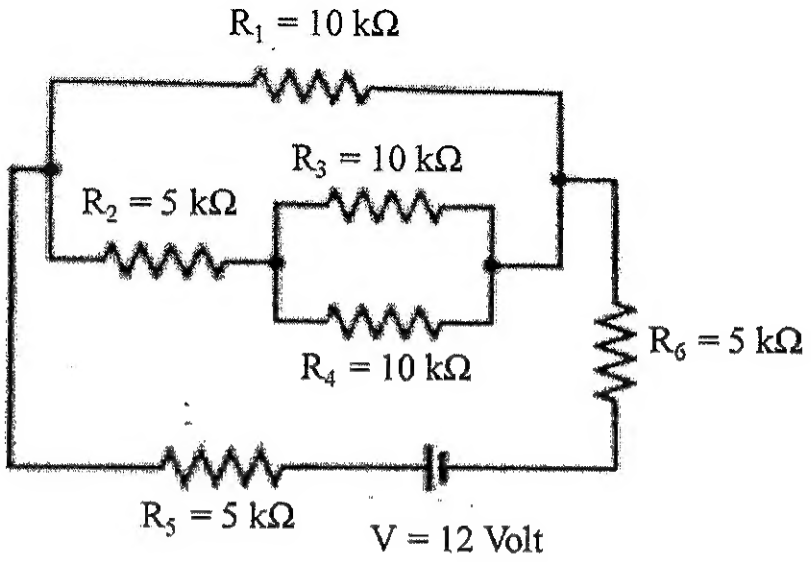

Figure Q3

A 12.0 Volt battery is connected in the circuit as shown in **Figure Q3**

a. Calculate the equivalent resistance. (5 marks)

b. How much current is drawn from the battery? (1 mark)

c. What is the current flows through the R_2 resistor? (2 marks)

d. Determine the voltage across R_2 and R_5 resistors. (2 marks)

Question 4 [10 marks]

a. i. Define Coulomb's law (1 mark)

ii State Law of Charges. (1 mark)

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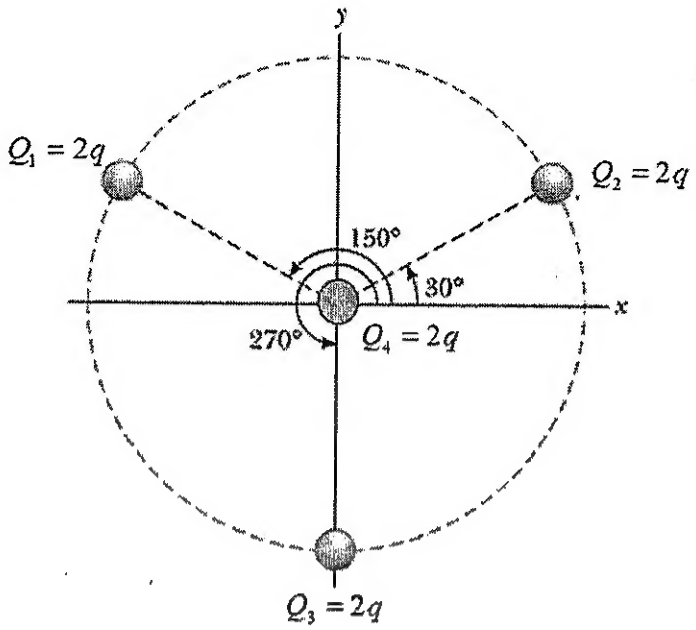

Figure Q4(b)

b. **Figure Q4(b)** shows four identical charges (q = -5 μC). Three of the charges lie along a circle of radius 2.0 m at angles of 30°, 150°, and 270°, as shown. What is the resultant electric force at Q_4, which is at the center of the circle? (8 marks)

Question 5 [10 marks]

a. Define the following terms

i. Doping.
ii. *p*-type semiconductor. (1 mark)

b. Explain how a pure semiconductor is changed to *n*-type semiconductor. (4 marks)

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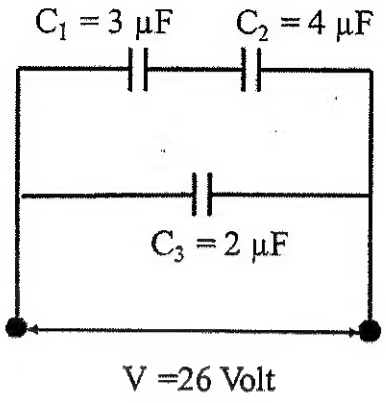

Figure Q5(c)

c. A 3.00 μF and a 4.00 μF capacitor are connected in series and this combination is connected in parallel with a 2.00 μF capacitor (**Figure Q5(c)**).

i. What is the net capacitance? (2 marks)

ii. If 26.0 V is applied across the whole network of **Figure Q5(c)**, calculate the voltage across C_1 and C_2 capacitor. (3 marks)

End of Paper